PREDICTED ENERGY ASSESSMENT

AES Sustainability Consultants

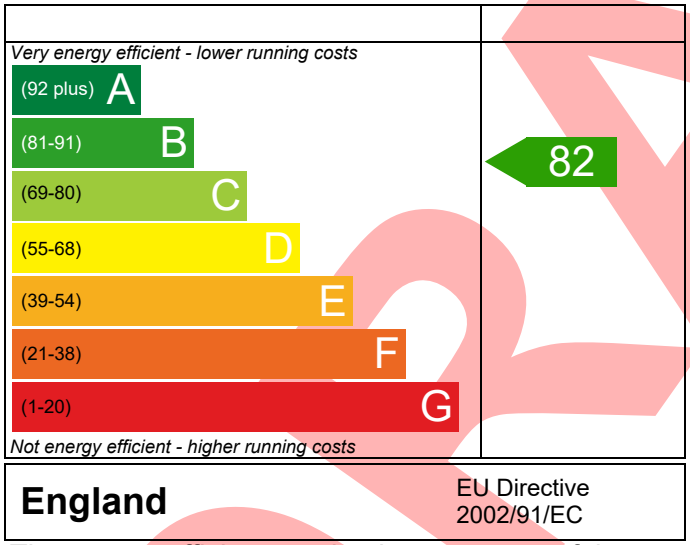
380, 1 Bed,
K, B

Dwelling type:	Maisonette, Semi-Detached
Date of assessment:	22/01/2024
Produced by:	Katarzyna Gotlib
Total floor area:	53.98 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO_2) emissions.

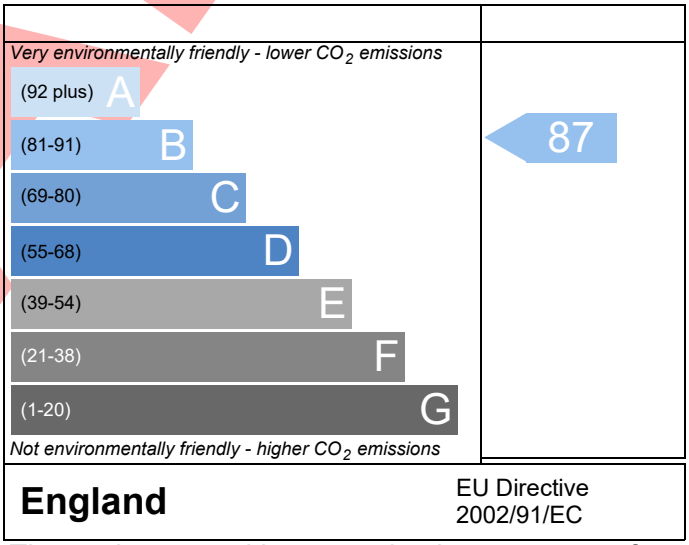
Energy Efficiency Rating



England EU Directive 2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



England EU Directive 2002/91/EC

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

BUILDING REGULATION COMPLIANCE
Calculation Type: New Build (As Designed)

AES Sustainability Consultants

Property Reference	4907-Z852-6657-0380	**Issued on Date**	22/01/2024
Assessment Reference	380	**Prop Type Ref**	Leadon End 1FM Op
Property	380, 1 Bed, K, B		

SAP Rating	82 B	**DER**	20.33	**TER**	21.20
Environmental	87 B	**% DER<TER**	4.08		
CO_2 Emissions (t/year)	0.95	**DFEE**	49.52	**TFEE**	55.44
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.68		

Assessor Details	Mrs. Katarzyna Gotlib, Katarzyna Gotlib, Tel: 01884 242 050, kat.gotlib@aessc.co.uk	**Assessor ID**	Z852-0001
Client	Redrow, Redrow		

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	21.20	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	20.33	$kgCO_2/m^2$	Pass
	-0.87 (-4.1%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.44	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	49.52	$kWh/m^2/yr$	
	-5.9 (-10.6%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.28 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.28 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.01 (design value)	$m^3/(h.m^2)$ @ 50 Pa	
Maximum	10.0	$m^3/(h.m^2)$ @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

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Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 35 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Programmer, room thermostat and TRVs		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Severn Valley)	Not significant	Pass

Based on:

Overshading	Average
Windows facing North East	0.93 m², No overhang
Windows facing South East	2.62 m², No overhang
Windows facing North West	2.81 m², No overhang
Air change rate	4.00 ach
Blinds/curtains	None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Solid Wall	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.01 (design value)	m³/(h.m²) @ 50 Pa	
Maximum	10.0	m³/(h.m²) @ 50 Pa	Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.11	W/m²K

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	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating			0	0	Not applicable
Photovoltaic			0	0	Not applicable
Wind turbine			0	0	Not applicable
Totals	**£0**	**£0**	**B 82**	**B 87**	

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FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

AES Sustainability Consultants

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Environmental	87 B	**% DER<TER**	4.08		
CO_2 Emissions (t/year)	0.95	**DFEE**	49.52	**TFEE**	55.44
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.68		

Assessor Details	Mrs. Katarzyna Gotlib, Katarzyna Gotlib, Tel: 01884 242 050, kat.gotlib@aessc.co.uk	**Assessor ID**	Z852-0001
Client	Redrow, Redrow		

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Semi-Detached Maisonette, total floor area 54 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 21.20 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 20.33 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.5 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.28 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.28 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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3 Air permeability
Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

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5 Cylinder insulation
Hot water storage: No cylinder

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6 Controls
Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

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7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

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8 Mechanical ventilation
Not applicable

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9 Summertime temperature
Overheating risk (Severn Valley): Not significant OK
Based on:
Overshading: Average
Windows facing North East: 0.93 m², No overhang
Windows facing South East: 2.62 m², No overhang
Windows facing North West: 2.81 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

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10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.2300 (1b)	x	2.7000 (2b)	=	11.4210	(1b) - (3b)
First floor	49.7500 (1c)	x	2.4500 (2c)	=	121.8875	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	133.3085	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1500	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4005	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3404	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4341	0.4256	0.4170	0.3745	0.3660	0.3234	0.3234	0.3149	0.3404	0.3660	0.3830	0.4000	(22b)
Effective ac	0.5942	0.5906	0.5870	0.5701	0.5670	0.5523	0.5523	0.5496	0.5580	0.5670	0.5733	0.5800	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Solid Door			2.0600	1.4000	2.8840			(26)
Window (Uw = 1.24)			6.3600	1.1814	7.5137			(27)
Jetfloor 150mm Grey on Grey			4.2300	0.1800	0.7614	75.0000	317.2500	(28a)
90mm Supafil 34 FF	56.4300	8.4200	48.0100	0.2700	12.9627	52.3000	2510.9230	(29a)
90mm Supafil Hi-Strength	13.9800		13.9800	0.2800	3.9144	52.3000	731.1540	(29a)
400mm Plane Ceiling	51.6700		51.6700	0.1100	5.6837	9.0000	465.0300	(30)
Total net area of external elements Aum(A, m2)			126.3100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.7199			(33)
E-WM-23/24/30			27.6500	0.0000	0.0000	45.0000	1244.2500	(32)
E-FC-14 Floor			46.4900			70.0000	3254.3000	(32d)
1F Timber			92.6600			9.0000	833.9400	(32c)
1F Internal Floor			2.3100			70.0000	161.7000	(32d)
Internal Ceiling GF			2.3100			30.0000	69.3000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9587.8470 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		177.6185 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.3506 (36)
Total fabric heat loss	(33) + (36) =	41.0705 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.1403	25.9794	25.8217	25.0807	24.9421	24.2968	24.2968	24.1773	24.5453	24.9421	25.2225	25.5157	(38)
Heat transfer coeff	67.2108	67.0499	66.8921	66.1512	66.0126	65.3673	65.3673	65.2478	65.6158	66.0126	66.2930	66.5862	(39)
Average = Sum(39)m / 12 =												66.1506	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2451	1.2421	1.2392	1.2255	1.2229	1.2110	1.2110	1.2087	1.2156	1.2229	1.2281	1.2335	(40)
HLP (average)												1.2255	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.8074 (42)
Average daily hot water use (litres/day)		77.1261 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.8387	81.7537	78.6686	75.5836	72.4985	69.4135	69.4135	72.4985	75.5836	78.6686	81.7537	84.8387	(44)
Energy conte	125.8134	110.0372	113.5485	98.9943	94.9874	81.9669	75.9544	87.1588	88.1997	102.7883	112.2015	121.8435	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1213.4940	(45)
Distribution loss (46)m = 0.15 x (45)m													
	18.8720	16.5056	17.0323	14.8492	14.2481	12.2950	11.3932	13.0738	13.2300	15.4182	16.8302	18.2765	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0127	12.6412	13.9709	13.4924	13.9218	13.4494	13.8831	13.9082	13.4728	13.9506	13.5329	14.0046	(61)
Total heat required for water heating calculated for each month													
	139.8261	122.6784	127.5195	112.4867	108.9093	95.4163	89.8375	101.0670	101.6725	116.7389	125.7344	135.8482	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	139.8261	122.6784	127.5195	112.4867	108.9093	95.4163	89.8375	101.0670	101.6725	116.7389	125.7344	135.8482	(64)
									Total per year (kWh/year) = Sum(64)m =			1377.7347	(64)
Heat gains from water heating, kWh/month													
	45.3361	39.7477	41.2476	36.2887	35.0638	30.6163	28.7256	32.4574	32.6946	37.6648	40.6902	44.0141	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.6538	13.9036	11.3072	8.5602	6.3989	5.4022	5.8373	7.5875	10.1839	12.9309	15.0922	16.0889	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	157.5532	159.1881	155.0682	146.2973	135.2258	124.8200	117.8684	116.2335	120.3534	129.1242	140.1958	150.6015	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	(71)
Water heating gains (Table 5)													
	60.9357	59.1483	55.4403	50.4010	47.1287	42.5227	38.6097	43.6255	45.4092	50.6247	56.5142	59.1588	(72)
Total internal gains													
	287.2539	285.3512	274.9269	258.3698	241.8646	225.8562	215.4266	220.5577	229.0577	245.7910	264.9134	278.9604	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	0.9300	11.2829	0.5200	0.0000	0.7700	4.2015	(75)
Southeast	2.6200	36.7938	0.5200	0.0000	0.7700	38.5985	(77)
Northwest	2.8100	11.2829	0.5200	0.0000	0.7700	12.6947	(81)

Solar gains	55.4947	100.1401	151.9232	213.2267	261.6382	269.7780	255.9200	218.2692	172.9110	114.6955	67.4918	46.8305	(83)
Total gains	342.7485	385.4913	426.8501	471.5965	503.5028	495.6342	471.3466	438.8268	401.9687	360.4865	332.4053	325.7909	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.6259	39.7210	39.8147	40.2606	40.3452	40.7435	40.7435	40.8181	40.5891	40.3452	40.1745	39.9976	
alpha	3.6417	3.6481	3.6543	3.6840	3.6897	3.7162	3.7162	3.7212	3.7059	3.6897	3.6783	3.6665	
util living area													
	0.9907	0.9849	0.9715	0.9361	0.8571	0.7167	0.5682	0.6209	0.8316	0.9536	0.9848	0.9923	(86)
MIT	19.2725	19.4546	19.7731	20.2043	20.5955	20.8596	20.9559	20.9384	20.7368	20.2398	19.6838	19.2402	(87)
Th 2	19.8841	19.8864	19.8888	19.8997	19.9017	19.9112	19.9112	19.9130	19.9076	19.9017	19.8976	19.8933	(88)
util rest of house													
	0.9884	0.9811	0.9640	0.9180	0.8144	0.6318	0.4451	0.4990	0.7660	0.9369	0.9804	0.9904	(89)
MIT 2	18.3204	18.5027	18.8190	19.2464	19.6103	19.8355	19.8964	19.8902	19.7450	19.2889	18.7400	18.2951	(90)
Living area fraction										fLA = Living area / (4) =		0.3800	(91)
MIT	18.6821	18.8644	19.1815	19.6104	19.9846	20.2246	20.2990	20.2885	20.1219	19.6502	19.0986	18.6542	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5321	18.7144	19.0315	19.4604	19.8346	20.0746	20.1490	20.1385	19.9719	19.5002	18.9486	18.5042	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9846	0.9757	0.9564	0.9092	0.8113	0.6458	0.4736	0.5262	0.7705	0.9291	0.9752	0.9870	(94)
Useful gains	337.4668	376.1402	408.2602	428.7662	408.5079	320.0755	223.2251	230.9321	309.7183	334.9256	324.1484	321.5663	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	956.5532	926.2525	838.2580	698.5812	536.9867	357.8612	231.9882	243.9272	385.2867	587.5253	785.4821	952.4620	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	460.6003	369.6755	319.9183	194.2668	95.5882	0.0000	0.0000	0.0000	0.0000	187.9342	332.1603	469.3864	(98)
Space heating												2429.5300	(98)
Space heating per m2											(98) / (4) =	45.0080	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2684.5635	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	460.6003	369.6755	319.9183	194.2668	95.5882	0.0000	0.0000	0.0000	0.0000	187.9342	332.1603	469.3864	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	508.9506	408.4812	353.5009	214.6595	105.6224	0.0000	0.0000	0.0000	0.0000	207.6621	367.0279	518.6590	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	139.8261	122.6784	127.5195	112.4867	108.9093	95.4163	89.8375	101.0670	101.6725	116.7389	125.7344	135.8482	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.7340	89.6809	89.5643	89.2997	88.7671	87.3000	87.3000	87.3000	87.3000	89.2465	89.5982	89.7615	(217)
Fuel for water heating, kWh/month													
	155.8229	136.7943	142.3775	125.9654	122.6910	109.2970	102.9066	115.7698	116.4634	130.8050	140.3315	151.3435	(219)
Water heating fuel used												1550.5677	(219)
Annual totals kWh/year													
Space heating fuel - main system												2684.5635	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												276.4515	(232)
Total delivered energy for all uses												4586.5827	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2684.5635	0.2160	579.8657	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1550.5677	0.2160	334.9226	(264)
Space and water heating			914.7883	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	276.4515	0.5190	143.4783	(268)
Total CO2, kg/year			1097.1917	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			20.3300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		20.3300	ZC1
Total Floor Area	TFA	53.9800	
Assumed number of occupants	N	1.8074	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.2958	ZC2
CO2 emissions from cooking, equation (L16)		3.0081	ZC3
Total CO2 emissions		40.6339	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		40.6339	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.2300	(1b)	x 2.7000	(2b) =	11.4210	(1b) - (3b)
First floor	49.7500	(1c)	x 2.4500	(2c) =	121.8875	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		133.3085	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1500	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3400	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4335	0.4250	0.4165	0.3740	0.3655	0.3230	0.3230	0.3145	0.3400	0.3655	0.3825	0.3995	(22b)
Effective ac	0.5940	0.5903	0.5867	0.5699	0.5668	0.5522	0.5522	0.5495	0.5578	0.5668	0.5732	0.5798	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0600	1.0000	2.0600			(26)
TER Opening Type (Uw = 1.40)			6.3600	1.3258	8.4318			(27)
Jetfloor 150mm Grey on Grey			4.2300	0.1300	0.5499			(28a)
90mm Supafil 34 FF	56.4300	8.4200	48.0100	0.1800	8.6418			(29a)
90mm Supafil Hi-Strength	13.9800		13.9800	0.1800	2.5164			(29a)
400mm Plane Ceiling	51.6700		51.6700	0.1300	6.7171			(30)
Total net area of external elements Aum(A, m2)			126.3100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.9170			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	8.4112	(36)
Total fabric heat loss (33) + (36) =	37.3282	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.1300	25.9695	25.8121	25.0730	24.9348	24.2910	24.2910	24.1718	24.5390	24.9348	25.2145	25.5069	(38)
Heat transfer coeff	63.4582	63.2977	63.1403	62.4012	62.2630	61.6193	61.6193	61.5000	61.8672	62.2630	62.5427	62.8352	(39)
Average = Sum(39)m / 12 =												62.4006	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1756	1.1726	1.1697	1.1560	1.1534	1.1415	1.1415	1.1393	1.1461	1.1534	1.1586	1.1640	(40)
HLP (average)												1.1560	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8074 (42)
Average daily hot water use (litres/day)	77.1261 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.8387	81.7537	78.6686	75.5836	72.4985	69.4135	69.4135	72.4985	75.5836	78.6686	81.7537	84.8387	(44)
Energy conte	125.8134	110.0372	113.5485	98.9943	94.9874	81.9669	75.9544	87.1588	88.1997	102.7883	112.2015	121.8435	(45)
Energy content (annual)										Total = Sum(45)m =		1213.4940	(45)
Distribution loss (46)m = 0.15 x (45)m	18.8720	16.5056	17.0323	14.8492	14.2481	12.2950	11.3932	13.0738	13.2300	15.4182	16.8302	18.2765	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	43.2329	37.6291	40.0887	37.2741	36.9445	34.2313	35.3724	36.9445	37.2741	40.0887	40.3169	43.2329 (61)
Total heat required for water heating calculated for each month												
	169.0463	147.6663	153.6372	136.2684	131.9319	116.1982	111.3268	124.1033	125.4738	142.8770	152.5183	165.0764 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	169.0463	147.6663	153.6372	136.2684	131.9319	116.1982	111.3268	124.1033	125.4738	142.8770	152.5183	165.0764 (64)
								Total per year (kWh/year) = Sum(64)m =				1676.1239 (64)
Heat gains from water heating, kWh/month												
	52.6412	45.9946	47.7770	42.2341	40.8194	35.8118	34.0979	38.2164	38.6449	44.1993	47.3862	51.3212 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.6538	13.9036	11.3072	8.5602	6.3989	5.4022	5.8373	7.5875	10.1839	12.9309	15.0922	16.0889	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	157.5532	159.1881	155.0682	146.2973	135.2258	124.8200	117.8684	116.2335	120.3534	129.1242	140.1958	150.6015	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	(71)
Water heating gains (Table 5)													
	70.7543	68.4444	64.2165	58.6585	54.8648	49.7387	45.8306	51.3661	53.6735	59.4076	65.8142	68.9801	(72)
Total internal gains													
	297.0725	294.6473	283.7030	266.6274	249.6007	233.0721	222.6474	228.2984	237.3221	254.5739	274.2134	288.7817	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	0.9300	11.2829	0.6300	0.7000	0.7700	3.2068	(75)
Southeast	2.6200	36.7938	0.6300	0.7000	0.7700	29.4610	(77)
Northwest	2.8100	11.2829	0.6300	0.7000	0.7700	9.6895	(81)

Solar gains	42.3574	76.4339	115.9583	162.7494	199.7004	205.9133	195.3359	166.5981	131.9776	87.5436	51.5144	35.7443 (83)
Total gains	339.4298	371.0812	399.6613	429.3767	449.3011	438.9854	417.9833	394.8965	369.2997	342.1175	325.7279	324.5260 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.0721	59.2219	59.3695	60.0727	60.2061	60.8351	60.8351	60.9530	60.5912	60.2061	59.9368	59.6579	
alpha	4.9381	4.9481	4.9580	5.0048	5.0137	5.0557	5.0557	5.0635	5.0394	5.0137	4.9958	4.9772	
util living area													
	0.9975	0.9957	0.9907	0.9735	0.9197	0.7871	0.6211	0.6731	0.8886	0.9803	0.9954	0.9980	(86)
MIT	19.7511	19.8744	20.0992	20.4142	20.7117	20.9149	20.9799	20.9702	20.8281	20.4573	20.0531	19.7301	(87)
Th 2	19.9396	19.9420	19.9443	19.9554	19.9574	19.9671	19.9671	19.9689	19.9634	19.9574	19.9532	19.9489	(88)
util rest of house													
	0.9967	0.9942	0.9872	0.9626	0.8845	0.6992	0.4890	0.5428	0.8269	0.9702	0.9934	0.9974	(89)
MIT 2	18.2804	18.4620	18.7907	19.2515	19.6602	19.9064	19.9592	19.9558	19.8170	19.3190	18.7313	18.2563	(90)
Living area fraction									fLA = Living area / (4) =			0.3800	(91)
MIT	18.8392	18.9986	19.2879	19.6933	20.0597	20.2896	20.3471	20.3412	20.2012	19.7515	19.2335	18.8163	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8392	18.9986	19.2879	19.6933	20.0597	20.2896	20.3471	20.3412	20.2012	19.7515	19.2335	18.8163	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9955	0.9924	0.9843	0.9592	0.8886	0.7293	0.5397	0.5927	0.8434	0.9675	0.9916	0.9963	(94)
Useful gains	337.8876	368.2455	393.3894	411.8479	399.2321	320.1344	225.6024	234.0464	311.4698	331.0078	322.9922	323.3399	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	922.6319	892.4114	807.4322	673.5132	520.4998	350.5895	230.8905	242.3848	377.4626	569.7974	758.8620	918.4179	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	435.0498	352.2395	308.0478	188.3990	90.2231	0.0000	0.0000	0.0000	0.0000	177.6595	313.8262	442.7381	(98)
Space heating												2308.1830	(98)
Space heating per m2											(98) / (4) =	42.7600	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2471.2881	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	435.0498	352.2395	308.0478	188.3990	90.2231	0.0000	0.0000	0.0000	0.0000	177.6595	313.8262	442.7381	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	465.7921	377.1301	329.8157	201.7120	96.5987	0.0000	0.0000	0.0000	0.0000	190.2136	336.0024	474.0236	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	169.0463	147.6663	153.6372	136.2684	131.9319	116.1982	111.3268	124.1033	125.4738	142.8770	152.5183	165.0764	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.3264	87.1616	86.7682	85.8670	84.1168	80.3000	80.3000	80.3000	80.3000	85.6008	86.8282	87.4139	(217)
Fuel for water heating, kWh/month													
	193.5798	169.4166	177.0661	158.6972	156.8437	144.7052	138.6386	154.5495	156.2563	166.9108	175.6552	188.8445	(219)
Water heating fuel used												1981.1635	(219)
Annual totals kWh/year													
Space heating fuel - main system												2471.2881	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												276.4515	(232)
Total delivered energy for all uses												4803.9031	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2471.2881	0.2160	533.7982	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1981.1635	0.2160	427.9313	(264)
Space and water heating			961.7295	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	276.4515	0.5190	143.4783	(268)
Total CO2, kg/m2/year			1144.1329	(272)
Emissions per m2 for space and water heating			17.8164	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.6580	(272b)
Emissions per m2 for pumps and fans			0.7211	(272c)
Target Carbon Dioxide Emission Rate (TER) = (17.8164 * 1.00) + 2.6580 + 0.7211, rounded to 2 d.p.			21.2000	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.2300	(1b)	x 2.7000	(2b) =	11.4210	(1b) - (3b)
First floor	49.7500	(1c)	x 2.4500	(2c) =	121.8875	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.9800					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	133.3085	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							2 * 10	=	20.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1500	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4005	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3404	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4341	0.4256	0.4170	0.3745	0.3660	0.3234	0.3234	0.3149	0.3404	0.3660	0.3830	0.4000	(22b)
Effective ac	0.5942	0.5906	0.5870	0.5701	0.5670	0.5523	0.5523	0.5496	0.5580	0.5670	0.5733	0.5800	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Solid Door			2.0600	1.4000	2.8840			(26)
Window (Uw = 1.24)			6.3600	1.1814	7.5137			(27)
Jetfloor 150mm Grey on Grey			4.2300	0.1800	0.7614	75.0000	317.2500	(28a)
90mm Supafil 34 FF	56.4300	8.4200	48.0100	0.2700	12.9627	52.3000	2510.9230	(29a)
90mm Supafil Hi-Strength	13.9800		13.9800	0.2800	3.9144	52.3000	731.1540	(29a)
400mm Plane Ceiling	51.6700		51.6700	0.1100	5.6837	9.0000	465.0300	(30)
Total net area of external elements Aum(A, m2)			126.3100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.7199			(33)
E-WM-23/24/30			27.6500	0.0000	0.0000	45.0000	1244.2500	(32)
E-FC-14 Floor			46.4900			70.0000	3254.3000	(32d)
1F Timber			92.6600			9.0000	833.9400	(32c)
1F Internal Floor			2.3100			70.0000	161.7000	(32d)
Internal Ceiling GF			2.3100			30.0000	69.3000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9587.8470 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		177.6185 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.3506 (36)
Total fabric heat loss	(33) + (36) =	41.0705 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.1403	25.9794	25.8217	25.0807	24.9421	24.2968	24.2968	24.1773	24.5453	24.9421	25.2225	25.5157	(38)
Heat transfer coeff	67.2108	67.0499	66.8921	66.1512	66.0126	65.3673	65.3673	65.2478	65.6158	66.0126	66.2930	66.5862	(39)
Average = Sum(39)m / 12 =												66.1506	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2451	1.2421	1.2392	1.2255	1.2229	1.2110	1.2110	1.2087	1.2156	1.2229	1.2281	1.2335	(40)
HLP (average)												1.2255	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		1.8074 (42)
Average daily hot water use (litres/day)		77.1261 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.8387	81.7537	78.6686	75.5836	72.4985	69.4135	69.4135	72.4985	75.5836	78.6686	81.7537	84.8387	(44)
Energy conte	125.8134	110.0372	113.5485	98.9943	94.9874	81.9669	75.9544	87.1588	88.1997	102.7883	112.2015	121.8435	(45)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1213.4940 (45)
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	26.7353	23.3829	24.1291	21.0363	20.1848	17.4180	16.1403	18.5212	18.7424	21.8425	23.8428	25.8918	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.6538	13.9036	11.3072	8.5602	6.3989	5.4022	5.8373	7.5875	10.1839	12.9309	15.0922	16.0889	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	157.5532	159.1881	155.0682	146.2973	135.2258	124.8200	117.8684	116.2335	120.3534	129.1242	140.1958	150.6015	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	(71)
Water heating gains (Table 5)													
	35.9346	34.7960	32.4315	29.2171	27.1301	24.1916	21.6940	24.8941	26.0312	29.3582	33.1150	34.8007	(72)
Total internal gains													
	259.2528	257.9989	248.9181	234.1859	218.8660	204.5251	195.5108	198.8264	206.6797	221.5245	238.5142	251.6024	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	0.9300	11.2829	0.5200	0.0000	0.7700	4.2015	(75)
Southeast	2.6200	36.7938	0.5200	0.0000	0.7700	38.5985	(77)
Northwest	2.8100	11.2829	0.5200	0.0000	0.7700	12.6947	(81)

Solar gains	55.4947	100.1401	151.9232	213.2267	261.6382	269.7780	255.9200	218.2692	172.9110	114.6955	67.4918	46.8305	(83)
Total gains	314.7475	358.1390	400.8413	447.4126	480.5042	474.3031	451.4309	417.0955	379.5907	336.2200	306.0061	298.4329	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, n1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.6259	39.7210	39.8147	40.2606	40.3452	40.7435	40.7435	40.8181	40.5891	40.3452	40.1745	39.9976	
alpha	3.6417	3.6481	3.6543	3.6840	3.6897	3.7162	3.7162	3.7212	3.7059	3.6897	3.6783	3.6665	
util living area													
	0.9930	0.9880	0.9764	0.9446	0.8712	0.7360	0.5880	0.6444	0.8508	0.9620	0.9884	0.9942	(86)
MIT	19.2128	19.3976	19.7216	20.1625	20.5668	20.8459	20.9506	20.9302	20.7116	20.1947	19.6286	19.1814	(87)
Th 2	19.8841	19.8864	19.8888	19.8997	19.9017	19.9112	19.9112	19.9130	19.9076	19.9017	19.8976	19.8933	(88)
util rest of house													
	0.9912	0.9849	0.9700	0.9285	0.8310	0.6521	0.4627	0.5212	0.7890	0.9479	0.9848	0.9928	(89)
MIT 2	18.2612	18.4465	18.7689	19.2075	19.5865	19.8270	19.8944	19.8867	19.7264	19.2467	18.6857	18.2367	(90)
Living area fraction										fLA = Living area / (4) =		0.3800	(91)
MIT	18.6228	18.8079	19.1309	19.5704	19.9590	20.2141	20.2957	20.2832	20.1007	19.6069	19.0440	18.5957	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6228	18.8079	19.1309	19.5704	19.9590	20.2141	20.2957	20.2832	20.1007	19.6069	19.0440	18.5957	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9885	0.9810	0.9644	0.9226	0.8334	0.6776	0.5094	0.5662	0.8017	0.9430	0.9812	0.9904	(94)
Useful gains	311.1137	351.3385	386.5875	412.7789	400.4634	321.3718	229.9735	236.1723	304.3071	317.0685	300.2522	295.5710	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	962.6462	932.5215	844.9079	705.8601	545.1964	366.9803	241.5796	253.3685	393.7424	594.5662	791.8029	958.5528	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	484.7402	390.5550	340.9904	211.0184	107.6813	0.0000	0.0000	0.0000	0.0000	206.4583	353.9165	493.2585	(98)
Space heating												2588.6186	(98)
Space heating per m2											(98) / (4) =	47.9551	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	614.4523	483.7178	495.8830	0.0000	0.0000	0.0000	0.0000	(100)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7935	0.8611	0.8309	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	487.5374	416.5228	412.0524	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	623.1209	595.1376	556.2657	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	97.6201	132.8894	107.2947	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												337.8043	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	24.4050	33.2224	26.8237	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												84.4511	(107)
Space cooling per m2												1.5645	(108)
Energy for space heating												47.9551	(99)
Energy for space cooling												1.5645	(108)
Total												49.5196	(109)
Dwelling Fabric Energy Efficiency (DFEE)												49.5	(109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.2300 (1b)	x	2.7000 (2b)	=	11.4210	(1b) - (3b)
First floor	49.7500 (1c)	x	2.4500 (2c)	=	121.8875	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	133.3085	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1500	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3400	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4335	0.4250	0.4165	0.3740	0.3655	0.3230	0.3230	0.3145	0.3400	0.3655	0.3825	0.3995	(22b)
Effective ac	0.5940	0.5903	0.5867	0.5699	0.5668	0.5522	0.5522	0.5495	0.5578	0.5668	0.5732	0.5798	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0600	1.0000	2.0600			(26)
TER Opening Type (Uw = 1.40)			6.3600	1.3258	8.4318			(27)
Jetfloor 150mm Grey on Grey			4.2300	0.1300	0.5499			(28a)
90mm Supafil 34 FF	56.4300	8.4200	48.0100	0.1800	8.6418			(29a)
90mm Supafil Hi-Strength	13.9800		13.9800	0.1800	2.5164			(29a)
400mm Plane Ceiling	51.6700		51.6700	0.1300	6.7171			(30)
Total net area of external elements Aum(A, m2)			126.3100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.9170			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4112	(36)
Total fabric heat loss					(33) + (36) =		37.3282	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.1300	25.9695	25.8121	25.0730	24.9348	24.2910	24.2910	24.1718	24.5390	24.9348	25.2145	25.5069	(38)
Heat transfer coeff	63.4582	63.2977	63.1403	62.4012	62.2630	61.6193	61.6193	61.5000	61.8672	62.2630	62.5427	62.8352	(39)
Average = Sum(39)m / 12 =												62.4006	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1756	1.1726	1.1697	1.1560	1.1534	1.1415	1.1415	1.1393	1.1461	1.1534	1.1586	1.1640	(40)
HLP (average)												1.1560	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8074	(42)
Average daily hot water use (litres/day)	77.1261	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.8387	81.7537	78.6686	75.5836	72.4985	69.4135	69.4135	72.4985	75.5836	78.6686	81.7537	84.8387	(44)
Energy conte	125.8134	110.0372	113.5485	98.9943	94.9874	81.9669	75.9544	87.1588	88.1997	102.7883	112.2015	121.8435	(45)
Energy content (annual)										Total = Sum(45)m =		1213.4940	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	26.7353	23.3829	24.1291	21.0363	20.1848	17.4180	16.1403	18.5212	18.7424	21.8425	23.8428	25.8918	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	90.3708	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	15.6538	13.9036	11.3072	8.5602	6.3989	5.4022	5.8373	7.5875	10.1839	12.9309	15.0922	16.0889	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	157.5532	159.1881	155.0682	146.2973	135.2258	124.8200	117.8684	116.2335	120.3534	129.1242	140.1958	150.6015	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	32.0371	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	(71)
Water heating gains (Table 5)													
	35.9346	34.7960	32.4315	29.2171	27.1301	24.1916	21.6940	24.8941	26.0312	29.3582	33.1150	34.8007	(72)
Total internal gains													
	259.2528	257.9989	248.9181	234.1859	218.8660	204.5251	195.5108	198.8264	206.6797	221.5245	238.5142	251.6024	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	0.9300	11.2829	0.6300	0.7000	0.7700	3.2068	(75)
Southeast	2.6200	36.7938	0.6300	0.7000	0.7700	29.4610	(77)
Northwest	2.8100	11.2829	0.6300	0.7000	0.7700	9.6895	(81)

Solar gains	42.3574	76.4339	115.9583	162.7494	199.7004	205.9133	195.3359	166.5981	131.9776	87.5436	51.5144	35.7443	(83)
Total gains	301.6102	334.4328	364.8764	396.9353	418.5664	410.4384	390.8467	365.4245	338.6573	309.0681	290.0287	287.3467	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.0721	59.2219	59.3695	60.0727	60.2061	60.8351	60.8351	60.9530	60.5912	60.2061	59.9368	59.6579	
alpha	4.9381	4.9481	4.9580	5.0048	5.0137	5.0557	5.0557	5.0635	5.0394	5.0137	4.9958	4.9772	
util living area													
	0.9986	0.9973	0.9937	0.9806	0.9365	0.8177	0.6561	0.7135	0.9145	0.9870	0.9972	0.9989	(86)
MIT	19.6863	19.8121	20.0414	20.3642	20.6748	20.8977	20.9744	20.9613	20.7960	20.4045	19.9923	19.6662	(87)
Th 2	19.9396	19.9420	19.9443	19.9554	19.9574	19.9671	19.9671	19.9689	19.9634	19.9574	19.9532	19.9489	(88)
util rest of house													
	0.9981	0.9963	0.9913	0.9723	0.9066	0.7338	0.5205	0.5816	0.8617	0.9800	0.9961	0.9985	(89)
MIT 2	18.7422	18.8696	19.0997	19.4271	19.7233	19.9156	19.9600	19.9567	19.8399	19.4710	19.0587	18.7295	(90)
Living area fraction									fLA = Living area / (4) =			0.3800	(91)
MIT	19.1009	19.2277	19.4575	19.7832	20.0848	20.2887	20.3454	20.3384	20.2032	19.8257	19.4134	19.0854	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1009	19.2277	19.4575	19.7832	20.0848	20.2887	20.3454	20.3384	20.2032	19.8257	19.4134	19.0854	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9955	0.9898	0.9706	0.9109	0.7628	0.5729	0.6325	0.8763	0.9788	0.9952	0.9981	(94)
Useful gains	300.8592	332.9127	361.1564	385.2496	381.2882	313.0872	223.9199	231.1186	296.7658	302.5271	288.6494	286.7865	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	939.2396	906.9105	818.1417	679.1251	522.0629	350.5353	230.7917	242.2146	377.5852	574.4210	770.1127	935.3247	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	474.9550	385.7265	339.9971	211.5904	104.7364	0.0000	0.0000	0.0000	0.0000	202.2891	346.6536	482.5124	(98)
Space heating												2548.4604	(98)
Space heating per m2											(98) / (4) =	47.2112	(99)

8c. Space cooling requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Calculated for June, July and August. See Table 10b													
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	579.2210	455.9825	467.4003	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8113	0.8873	0.8587	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	469.9150	404.5837	401.3785	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	548.4738	524.3250	495.8710	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	56.5623	89.0875	70.3025	0.0000	0.0000	0.0000	0.0000	(104)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												215.9523 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000		0.0000 (106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	14.1406	22.2719	17.5756	0.0000	0.0000	0.0000		0.0000 (107)
Space cooling												53.9881 (107)
Space cooling per m2												1.0001 (108)
Energy for space heating												47.2112 (99)
Energy for space cooling												1.0001 (108)
Total												48.2113 (109)
Target Fabric Energy Efficiency (TFEE)												55.4 (109)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.2300	(1b)	x 2.7000	(2b) =	11.4210	(1b) - (3b)
First floor	49.7500	(1c)	x 2.4500	(2c) =	121.8875	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		133.3085	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							2 * 10 =		20.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1500	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4005	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3404	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.9000	4.6000	4.7000	4.3000	4.3000	3.8000	3.8000	3.7000	3.8000	4.3000	4.3000	4.6000	(22)
Wind factor	1.2250	1.1500	1.1750	1.0750	1.0750	0.9500	0.9500	0.9250	0.9500	1.0750	1.0750	1.1500	(22a)
Adj infilt rate	0.4170	0.3915	0.4000	0.3660	0.3660	0.3234	0.3234	0.3149	0.3234	0.3660	0.3660	0.3915	(22b)
Effective ac	0.5870	0.5766	0.5800	0.5670	0.5670	0.5523	0.5523	0.5496	0.5523	0.5670	0.5670	0.5766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Solid Door			2.0600	1.4000	2.8840			(26)
Window (Uw = 1.24)			6.3600	1.1814	7.5137			(27)
Jetfloor 150mm Grey on Grey			4.2300	0.1800	0.7614	75.0000	317.2500	(28a)
90mm Supafil 34 FF	56.4300	8.4200	48.0100	0.2700	12.9627	52.3000	2510.9230	(29a)
90mm Supafil Hi-Strength	13.9800		13.9800	0.2800	3.9144	52.3000	731.1540	(29a)
400mm Plane Ceiling	51.6700		51.6700	0.1100	5.6837	9.0000	465.0300	(30)
Total net area of external elements Aum(A, m2)			126.3100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.7199			(33)
E-WM-23/24/30			27.6500	0.0000	0.0000	45.0000	1244.2500	(32)
E-FC-14 Floor			46.4900			70.0000	3254.3000	(32d)
1F Timber			92.6600			9.0000	833.9400	(32c)
1F Internal Floor			2.3100			70.0000	161.7000	(32d)
Internal Ceiling GF			2.3100			30.0000	69.3000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9587.8470 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		177.6185 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.3506 (36)
Total fabric heat loss	(33) + (36) =	41.0705 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.8217	25.3675	25.5157	24.9421	24.9421	24.2968	24.2968	24.1773	24.2968	24.9421	24.9421	25.3675	(38)
Heat transfer coeff	66.8921	66.4380	66.5862	66.0126	66.0126	65.3673	65.3673	65.2478	65.3673	66.0126	66.0126	66.4380	(39)
Average = Sum(39)m / 12 =												65.9795	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2392	1.2308	1.2335	1.2229	1.2229	1.2110	1.2110	1.2087	1.2110	1.2229	1.2229	1.2308	(40)
HLP (average)												1.2223	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8074 (42)
Average daily hot water use (litres/day)	77.1261 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.8387	81.7537	78.6686	75.5836	72.4985	69.4135	69.4135	72.4985	75.5836	78.6686	81.7537	84.8387	(44)
Energy conte	125.8134	110.0372	113.5485	98.9943	94.9874	81.9669	75.9544	87.1588	88.1997	102.7883	112.2015	121.8435	(45)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual) Total = Sum(45)m = 1213.4940 (45)

Distribution loss (46)m = 0.15 x (45)m

	18.8720	16.5056	17.0323	14.8492	14.2481	12.2950	11.3932	13.0738	13.2300	15.4182	16.8302	18.2765 (46)

Water storage loss:

Total storage loss

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0127	12.6412	13.9709	13.4924	13.9218	13.4494	13.8831	13.9082	13.4728	13.9506	13.5329	14.0046 (61)

Total heat required for water heating calculated for each month

	139.8261	122.6784	127.5195	112.4867	108.9093	95.4163	89.8375	101.0670	101.6725	116.7389	125.7344	135.8482 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	139.8261	122.6784	127.5195	112.4867	108.9093	95.4163	89.8375	101.0670	101.6725	116.7389	125.7344	135.8482 (64)

Total per year (kWh/year) = Sum(64)m = 1377.7347 (64)

RHI water heating demand 1378 (64)

Heat gains from water heating, kWh/month

	45.3361	39.7477	41.2476	36.2887	35.0638	30.6163	28.7256	32.4574	32.6946	37.6648	40.6902	44.0141 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	39.1346	34.7590	28.2679	21.4006	15.9972	13.5055	14.5932	18.9688	25.4599	32.3271	37.7306	40.2222	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	235.1540	237.5941	231.4450	218.3542	201.8295	186.2986	175.9229	173.4828	179.6319	192.7227	209.2474	224.7784	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	(71)

Water heating gains (Table 5)

	60.9357	59.1483	55.4403	50.4010	47.1287	42.5227	38.6097	43.6255	45.4092	50.6247	56.5142	59.1588	(72)

Total internal gains

	422.0244	418.3016	401.9535	376.9561	351.7557	329.1270	315.9260	322.8773	337.3012	362.4747	390.2924	410.9596	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	0.9300	13.7804	0.5200	0.0000	0.7700	5.1314	(75)
Southeast	2.6200	43.0593	0.5200	0.0000	0.7700	45.1713	(77)
Northwest	2.8100	13.7804	0.5200	0.0000	0.7700	15.5047	(81)

Solar gains	65.8074	105.9158	162.3768	234.5115	272.4239	303.9250	277.8227	241.1157	191.8677	124.8879	7.8913	53.6629	(83)
Total gains	487.8318	524.2174	564.3303	611.4675	624.1796	633.0520	593.7487	563.9929	529.1688	487.3626	398.1837	464.6225	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.8147	40.0868	39.9976	40.3452	40.3452	40.7435	40.7435	40.8181	40.7435	40.3452	40.3452	40.0868	
alpha	3.6543	3.6725	3.6665	3.6897	3.6897	3.7162	3.7162	3.7212	3.7162	3.6897	3.6897	3.6725	
util living area	0.9689	0.9586	0.9307	0.8678	0.7576	0.5751	0.4574	0.4781	0.7013	0.8848	0.9690	0.9730	(86)
MIT	19.6647	19.8032	20.0995	20.4639	20.7604	20.9374	20.9789	20.9758	20.8658	20.5069	19.9231	19.6327	(87)
Th 2	19.8888	19.8954	19.8933	19.9017	19.9017	19.9112	19.9112	19.9130	19.9112	19.9017	19.9017	19.8954	(88)
util rest of house	0.9618	0.9491	0.9143	0.8364	0.6998	0.4862	0.3487	0.3658	0.6186	0.8499	0.9601	0.9666	(89)
MIT 2	18.7100	18.8501	19.1354	19.4838	19.7429	19.8818	19.9049	19.9056	19.8380	19.5317	18.9777	18.6841	(90)
Living area fraction									fLA = Living area / (4) =			0.3800	(91)
MIT	19.0727	19.2122	19.5017	19.8562	20.1295	20.2829	20.3130	20.3122	20.2285	19.9022	19.3369	19.0445	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.9227	19.0622	19.3517	19.7062	19.9795	20.1329	20.1630	20.1622	20.0785	19.7522	19.1869	18.8945	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9538	0.9402	0.9047	0.8300	0.7043	0.5052	0.3746	0.3925	0.6324	0.8443	0.9525	0.9593	(94)
Useful gains	465.2856	492.8917	510.5411	507.5112	439.6259	319.8390	222.4326	221.3417	334.6601	411.4913	379.2640	445.6893	(95)
Ext temp.	4.9000	5.3000	7.0000	9.3000	12.2000	15.0000	16.7000	16.7000	14.4000	11.1000	7.8000	4.9000	(96)
Heat loss rate W	938.0117	914.3365	822.4528	686.9391	513.5475	335.5247	226.3646	225.9005	371.1900	571.1565	751.6796	929.7675	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	351.7082	283.2109	232.0624	129.1881	54.9976	0.0000	0.0000	0.0000	0.0000	118.7909	268.1392	360.1542	(98)

Space heating 1798.2515 (98)

RHI space heating demand 1798 (98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.2300	(1b)	x 2.7000	(2b) =	11.4210	(1b) - (3b)
First floor	49.7500	(1c)	x 2.4500	(2c) =	121.8875	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		133.3085	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =		0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =		0.0000	(6b)
Number of intermittent fans							2 * 10 =		20.0000	(7a)
Number of passive vents							0 * 10 =		0.0000	(7b)
Number of flueless gas fires							0 * 40 =		0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1500	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4005	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3404	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4341	0.4256	0.4170	0.3745	0.3660	0.3234	0.3234	0.3149	0.3404	0.3660	0.3830	0.4000	(22b)
Effective ac	0.5942	0.5906	0.5870	0.5701	0.5670	0.5523	0.5523	0.5496	0.5580	0.5670	0.5733	0.5800	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Solid Door			2.0600	1.4000	2.8840			(26)
Window (Uw = 1.24)			6.3600	1.1814	7.5137			(27)
Jetfloor 150mm Grey on Grey			4.2300	0.1800	0.7614	75.0000	317.2500	(28a)
90mm Supafil 34 FF	56.4300	8.4200	48.0100	0.2700	12.9627	52.3000	2510.9230	(29a)
90mm Supafil Hi-Strength	13.9800		13.9800	0.2800	3.9144	52.3000	731.1540	(29a)
400mm Plane Ceiling	51.6700		51.6700	0.1100	5.6837	9.0000	465.0300	(30)
Total net area of external elements Aum(A, m2)			126.3100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.7199			(33)
E-WM-23/24/30			27.6500	0.0000	0.0000	45.0000	1244.2500	(32)
E-FC-14 Floor			46.4900			70.0000	3254.3000	(32d)
1F Timber			92.6600			9.0000	833.9400	(32c)
1F Internal Floor			2.3100			70.0000	161.7000	(32d)
Internal Ceiling GF			2.3100			30.0000	69.3000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9587.8470 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		177.6185 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.3506 (36)
Total fabric heat loss	(33) + (36) =	41.0705 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.1403	25.9794	25.8217	25.0807	24.9421	24.2968	24.2968	24.1773	24.5453	24.9421	25.2225	25.5157	(38)
Heat transfer coeff	67.2108	67.0499	66.8921	66.1512	66.0126	65.3673	65.3673	65.2478	65.6158	66.0126	66.2930	66.5862	(39)
Average = Sum(39)m / 12 =												66.1506	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2451	1.2421	1.2392	1.2255	1.2229	1.2110	1.2110	1.2087	1.2156	1.2229	1.2281	1.2335	(40)
HLP (average)												1.2255	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8074 (42)
Average daily hot water use (litres/day)	77.1261 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.8387	81.7537	78.6686	75.5836	72.4985	69.4135	69.4135	72.4985	75.5836	78.6686	81.7537	84.8387	(44)
Energy conte	125.8134	110.0372	113.5485	98.9943	94.9874	81.9669	75.9544	87.1588	88.1997	102.7883	112.2015	121.8435	(45)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1213.4940	(45)
Distribution loss (46)m = 0.15 x (45)m													
	18.8720	16.5056	17.0323	14.8492	14.2481	12.2950	11.3932	13.0738	13.2300	15.4182	16.8302	18.2765	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0127	12.6412	13.9709	13.4924	13.9218	13.4494	13.8831	13.9082	13.4728	13.9506	13.5329	14.0046	(61)
Total heat required for water heating calculated for each month													
	139.8261	122.6784	127.5195	112.4867	108.9093	95.4163	89.8375	101.0670	101.6725	116.7389	125.7344	135.8482	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	139.8261	122.6784	127.5195	112.4867	108.9093	95.4163	89.8375	101.0670	101.6725	116.7389	125.7344	135.8482	(64)
								Total per year (kWh/year) = Sum(64)m =				1377.7347	(64)
Heat gains from water heating, kWh/month													
	45.3361	39.7477	41.2476	36.2887	35.0638	30.6163	28.7256	32.4574	32.6946	37.6648	40.6902	44.0141	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	39.1346	34.7590	28.2679	21.4006	15.9972	13.5055	14.5932	18.9688	25.4599	32.3271	37.7306	40.2222	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	235.1540	237.5941	231.4450	218.3542	201.8295	186.2986	175.9229	173.4828	179.6319	192.7227	209.2474	224.7784	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	(71)
Water heating gains (Table 5)													
	60.9357	59.1483	55.4403	50.4010	47.1287	42.5227	38.6097	43.6255	45.4092	50.6247	56.5142	59.1588	(72)
Total internal gains													
	422.0244	418.3016	401.9535	376.9561	351.7557	329.1270	315.9260	322.8773	337.3012	362.4747	390.2924	410.9596	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	0.9300	11.2829	0.5200	0.0000	0.7700	4.2015	(75)
Southeast	2.6200	36.7938	0.5200	0.0000	0.7700	38.5985	(77)
Northwest	2.8100	11.2829	0.5200	0.0000	0.7700	12.6947	(81)

Solar gains	55.4947	100.1401	151.9232	213.2267	261.6382	269.7780	255.9200	218.2692	172.9110	114.6955	67.4918	46.8305	(83)
Total gains	477.5191	518.4418	553.8767	590.1828	613.3939	598.9050	571.8461	541.1464	510.2121	477.1703	457.7842	457.7901	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.6259	39.7210	39.8147	40.2606	40.3452	40.7435	40.7435	40.8181	40.5891	40.3452	40.1745	39.9976	
alpha	3.6417	3.6481	3.6543	3.6840	3.6897	3.7162	3.7162	3.7212	3.7059	3.6897	3.6783	3.6665	
util living area													
	0.9739	0.9630	0.9402	0.8875	0.7871	0.6305	0.4827	0.5253	0.7381	0.9026	0.9601	0.9773	(86)
MIT	19.5495	19.7187	20.0075	20.3868	20.7092	20.9094	20.9743	20.9646	20.8308	20.4326	19.9323	19.5148	(87)
Th 2	19.8841	19.8864	19.8888	19.8997	19.9017	19.9112	19.9112	19.9130	19.9076	19.9017	19.8976	19.8933	(88)
util rest of house													
	0.9680	0.9546	0.9262	0.8602	0.7352	0.5449	0.3721	0.4134	0.6610	0.8733	0.9496	0.9722	(89)
MIT 2	18.5928	18.7604	19.0434	19.4121	19.7011	19.8649	19.9031	19.9008	19.8103	19.4640	18.9811	18.5659	(90)
Living area fraction										fLA = Living area / (4) =		0.3800	(91)
MIT	18.9563	19.1245	19.4097	19.7824	20.0841	20.2618	20.3101	20.3050	20.1980	19.8320	19.3425	18.9265	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.8063	18.9745	19.2597	19.6324	19.9341	20.1118	20.1601	20.1550	20.0480	19.6820	19.1925	18.7765	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9607	0.9460	0.9166	0.8525	0.7369	0.5617	0.3983	0.4395	0.6720	0.8662	0.9411	0.9654	(94)
Useful gains	458.7302	490.4368	507.6581	503.1489	451.9920	336.3979	227.7561	237.8077	342.8605	413.3381	430.8171	441.9352	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	974.9798	943.6953	853.5227	709.9646	543.5544	360.2890	232.7126	245.0050	390.2854	599.5280	801.6500	970.5910	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	384.0897	304.5897	257.3233	148.9073	68.1224	0.0000	0.0000	0.0000	0.0000	138.5253	266.9997	393.3199	(98)
Space heating												1961.8774	(98)
Space heating per m2											(98) / (4) =	36.3445	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2167.8204	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	384.0897	304.5897	257.3233	148.9073	68.1224	0.0000	0.0000	0.0000	0.0000	138.5253	266.9997	393.3199	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	424.4085	336.5632	284.3352	164.5384	75.2734	0.0000	0.0000	0.0000	0.0000	153.0666	295.0273	434.6077	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	139.8261	122.6784	127.5195	112.4867	108.9093	95.4163	89.8375	101.0670	101.6725	116.7389	125.7344	135.8482	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.6232	89.5574	89.4140	89.0946	88.5042	87.3000	87.3000	87.3000	87.3000	89.0079	89.4503	89.6563	(217)
Fuel for water heating, kWh/month													
	156.0155	136.9829	142.6169	126.2553	123.0555	109.2970	102.9066	115.7698	116.4634	131.1557	140.5635	151.5210	(219)
Water heating fuel used												1552.6030	(219)
Annual totals kWh/year													
Space heating fuel - main system												2167.8204	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												276.4515	(232)
Total delivered energy for all uses												4071.8748	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2167.8204	3.4800	75.4401	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1552.6030	3.4800	54.0306	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	276.4515	13.1900	36.4640	(250)
Additional standing charges			120.0000	(251)
Total energy cost			295.8272	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.2553	(257)
SAP value		82.4889	
SAP rating (Section 12)		82	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2167.8204	0.2160	468.2492	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1552.6030	0.2160	335.3622	(264)
Space and water heating			803.6114	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	276.4515	0.5190	143.4783	(268)
Total kg/year			986.0148	(272)
CO2 emissions per m2			18.2700	(273)
EI value			86.6512	
EI rating			87	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9050 = 3.845, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9050 = 0.2387, stars = 4
Water heating energy efficiency	3.48 / 0.8863 = 3.927, stars = 4
Water heating environmental impact	0.216 / 0.8863 = 0.2437, stars = 4

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.2300 (1b)	x	2.7000 (2b)	=	11.4210	(1b) - (3b)
First floor	49.7500 (1c)	x	2.4500 (2c)	=	121.8875	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	133.3085	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1500	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4005	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3404	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.9000	4.6000	4.7000	4.3000	4.3000	3.8000	3.8000	3.7000	3.8000	4.3000	4.3000	4.6000	(22)
Wind factor	1.2250	1.1500	1.1750	1.0750	1.0750	0.9500	0.9500	0.9250	0.9500	1.0750	1.0750	1.1500	(22a)
Adj infilt rate	0.4170	0.3915	0.4000	0.3660	0.3660	0.3234	0.3234	0.3149	0.3234	0.3660	0.3660	0.3915	(22b)
Effective ac	0.5870	0.5766	0.5800	0.5670	0.5670	0.5523	0.5523	0.5496	0.5523	0.5670	0.5670	0.5766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Solid Door			2.0600	1.4000	2.8840			(26)
Window (Uw = 1.24)			6.3600	1.1814	7.5137			(27)
Jetfloor 150mm Grey on Grey			4.2300	0.1800	0.7614	75.0000	317.2500	(28a)
90mm Supafil 34 FF	56.4300	8.4200	48.0100	0.2700	12.9627	52.3000	2510.9230	(29a)
90mm Supafil Hi-Strength	13.9800		13.9800	0.2800	3.9144	52.3000	731.1540	(29a)
400mm Plane Ceiling	51.6700		51.6700	0.1100	5.6837	9.0000	465.0300	(30)
Total net area of external elements Aum(A, m2)			126.3100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.7199			(33)
E-WM-23/24/30			27.6500	0.0000	0.0000	45.0000	1244.2500	(32)
E-FC-14 Floor			46.4900			70.0000	3254.3000	(32d)
1F Timber			92.6600			9.0000	833.9400	(32c)
1F Internal Floor			2.3100			70.0000	161.7000	(32d)
Internal Ceiling GF			2.3100			30.0000	69.3000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9587.8470 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		177.6185 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.3506 (36)
Total fabric heat loss	(33) + (36) =	41.0705 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.8217	25.3675	25.5157	24.9421	24.9421	24.2968	24.2968	24.1773	24.2968	24.9421	24.9421	25.3675	(38)
Heat transfer coeff	66.8921	66.4380	66.5862	66.0126	66.0126	65.3673	65.3673	65.2478	65.3673	66.0126	66.0126	66.4380	(39)
Average = Sum(39)m / 12 =												65.9795	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2392	1.2308	1.2335	1.2229	1.2229	1.2110	1.2110	1.2087	1.2110	1.2229	1.2229	1.2308	(40)
HLP (average)												1.2223	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.8074 (42)
Average daily hot water use (litres/day)	77.1261 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	84.8387	81.7537	78.6686	75.5836	72.4985	69.4135	69.4135	72.4985	75.5836	78.6686	81.7537	84.8387	(44)
Energy conte	125.8134	110.0372	113.5485	98.9943	94.9874	81.9669	75.9544	87.1588	88.1997	102.7883	112.2015	121.8435	(45)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1213.4940	(45)
Distribution loss (46)m = 0.15 x (45)m													
	18.8720	16.5056	17.0323	14.8492	14.2481	12.2950	11.3932	13.0738	13.2300	15.4182	16.8302	18.2765	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0127	12.6412	13.9709	13.4924	13.9218	13.4494	13.8831	13.9082	13.4728	13.9506	13.5329	14.0046	(61)
Total heat required for water heating calculated for each month													
	139.8261	122.6784	127.5195	112.4867	108.9093	95.4163	89.8375	101.0670	101.6725	116.7389	125.7344	135.8482	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	139.8261	122.6784	127.5195	112.4867	108.9093	95.4163	89.8375	101.0670	101.6725	116.7389	125.7344	135.8482	(64)
								Total per year (kWh/year) = Sum(64)m =				1377.7347	(64)
Heat gains from water heating, kWh/month													
	45.3361	39.7477	41.2476	36.2887	35.0638	30.6163	28.7256	32.4574	32.6946	37.6648	40.6902	44.0141	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	108.4449	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	39.1346	34.7590	28.2679	21.4006	15.9972	13.5055	14.5932	18.9688	25.4599	32.3271	37.7306	40.2222	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	235.1540	237.5941	231.4450	218.3542	201.8295	186.2986	175.9229	173.4828	179.6319	192.7227	209.2474	224.7784	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	47.6519	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	-72.2966	(71)
Water heating gains (Table 5)													
	60.9357	59.1483	55.4403	50.4010	47.1287	42.5227	38.6097	43.6255	45.4092	50.6247	56.5142	59.1588	(72)
Total internal gains													
	422.0244	418.3016	401.9535	376.9561	351.7557	329.1270	315.9260	322.8773	337.3012	362.4747	390.2924	410.9596	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	0.9300	13.7804	0.5200	0.0000	0.7700	5.1314	(75)
Southeast	2.6200	43.0593	0.5200	0.0000	0.7700	45.1713	(77)
Northwest	2.8100	13.7804	0.5200	0.0000	0.7700	15.5047	(81)

Solar gains	65.8074	105.9158	162.3768	234.5115	272.4239	303.9250	277.8227	241.1157	191.8677	124.8879	7.8913	53.6629	(83)
Total gains	487.8318	524.2174	564.3303	611.4675	624.1796	633.0520	593.7487	563.9929	529.1688	487.3626	398.1837	464.6225	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.8147	40.0868	39.9976	40.3452	40.3452	40.7435	40.7435	40.8181	40.7435	40.3452	40.3452	40.0868	
alpha	3.6543	3.6725	3.6665	3.6897	3.6897	3.7162	3.7162	3.7212	3.7162	3.6897	3.6897	3.6725	
util living area													
	0.9689	0.9586	0.9307	0.8678	0.7576	0.5751	0.4574	0.4781	0.7013	0.8848	0.9690	0.9730	(86)
MIT	19.6647	19.8032	20.0995	20.4639	20.7604	20.9374	20.9789	20.9758	20.8658	20.5069	19.9231	19.6327	(87)
Th 2	19.8888	19.8954	19.8933	19.9017	19.9017	19.9112	19.9112	19.9130	19.9112	19.9017	19.9017	19.8954	(88)
util rest of house													
	0.9618	0.9491	0.9143	0.8364	0.6998	0.4862	0.3487	0.3658	0.6186	0.8499	0.9601	0.9666	(89)
MIT 2	18.7100	18.8501	19.1354	19.4838	19.7429	19.8818	19.9049	19.9056	19.8380	19.5317	18.9777	18.6841	(90)
Living area fraction										fLA = Living area / (4) =		0.3800	(91)
MIT	19.0727	19.2122	19.5017	19.8562	20.1295	20.2829	20.3130	20.3122	20.2285	19.9022	19.3369	19.0445	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.9227	19.0622	19.3517	19.7062	19.9795	20.1329	20.1630	20.1622	20.0785	19.7522	19.1869	18.8945	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9538	0.9402	0.9047	0.8300	0.7043	0.5052	0.3746	0.3925	0.6324	0.8443	0.9525	0.9593	(94)
Useful gains	465.2856	492.8917	510.5411	507.5112	439.6259	319.8390	222.4326	221.3417	334.6601	411.4913	379.2640	445.6893	(95)
Ext temp.	4.9000	5.3000	7.0000	9.3000	12.2000	15.0000	16.7000	16.7000	14.4000	11.1000	7.8000	4.9000	(96)
Heat loss rate W													
	938.0117	914.3365	822.4528	686.9391	513.5475	335.5247	226.3646	225.9005	371.1900	571.1565	751.6796	929.7675	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	351.7082	283.2109	232.0624	129.1881	54.9976	0.0000	0.0000	0.0000	0.0000	118.7909	268.1392	360.1542	(98)
Space heating												1798.2515	(98)
Space heating per m2											(98) / (4) =	33.3133	(99)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1987.0182	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	351.7082	283.2109	232.0624	129.1881	54.9976	0.0000	0.0000	0.0000	0.0000	118.7909	268.1392	360.1542	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	388.6278	312.9402	256.4225	142.7492	60.7708	0.0000	0.0000	0.0000	0.0000	131.2607	296.2864	397.9605	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	139.8261	122.6784	127.5195	112.4867	108.9093	95.4163	89.8375	101.0670	101.6725	116.7389	125.7344	135.8482	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.5661	89.5083	89.3387	88.9819	88.3482	87.3000	87.3000	87.3000	87.3000	88.8851	89.4533	89.6005	(217)
Fuel for water heating, kWh/month													
	156.1150	137.0580	142.7371	126.4153	123.2728	109.2970	102.9066	115.7698	116.4634	131.3368	140.5588	151.6155	(219)
Water heating fuel used												1553.5461	(219)
Annual totals kWh/year													
Space heating fuel - main system												1987.0182	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												276.4515	(232)
Total delivered energy for all uses												3892.0158	(238)

10a. Fuel costs - using BEDF prices (506)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1987.0182	3.7400	74.3145	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1553.5461	3.7400	58.1026	(247)
Pumps and fans for heating	75.0000	20.4300	15.3225	(249)
Energy for lighting	276.4515	20.4300	56.4790	(250)
Additional standing charges			95.0000	(251)
Total energy cost			299.2187	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1987.0182	0.2160	429.1959	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1553.5461	0.2160	335.5660	(264)
Space and water heating			764.7619	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	276.4515	0.5190	143.4783	(268)
Total kg/year			947.1652	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1987.0182	1.2200	2424.1622	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1553.5461	1.2200	1895.3262	(264)
Space and water heating			4319.4884	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	276.4515	3.0700	848.7062	(268)
Primary energy kWh/year			5398.4446	(272)
Primary energy kWh/m2/year			100.0082	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 82
Current environmental impact rating:	B 87

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

(For testing purposes):		
A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
A2		Not considered
A3		Not considered
T2		Not considered
W		Not considered
X		Not considered
Y		Not considered
J2		Not considered
Q2		Not considered
Z1		Not considered
Z2		Not considered
Z3		Not considered
Z4		Not considered
Z5		Not considered
V2	Wind turbine	Not applicable
L2		Not considered
Q3		Not considered
O3		Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: B 82
Potential environmental impact rating: B 87

Fuel prices for cost data on this page from database revision number 506 TEST (30 Sep 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Severn Valley):

	Current	Potential	Saving
Electricity	£72	£72	£0
Mains gas	£227	£227	£0
Space heating	£185	£185	£0
Water heating	£58	£58	£0
Lighting	£56	£56	£0
Total cost of fuels	£299	£299	£0
Total cost of uses	£299	£299	£0
Delivered energy	72 kWh/m²	72 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	18 kg/m²	18 kg/m²	0 kg/m²
Primary energy	100 kWh/m²	100 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached Maisonette
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Severn Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	177.6 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	175.97 (P1)
Transmission heat loss coefficient	41.07 (37)
Summer heat loss coefficient	217.04 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
North East	0.000	1.000	None
South East	0.000	1.000	None
North West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	0.9300	100.3588	0.5200	0.0000	0.9000	43.6802
South East	2.6200	121.5729	0.5200	0.0000	0.9000	149.0678
North West	2.8100	100.3588	0.5200	0.0000	0.9000	131.9799
total:						324.7278

	Jun	Jul	Aug	
Solar gains	355	325	282	(P3/P4)
Internal gains	326	313	320	
Total summer gains	681	638	602	(P5)
Summer gain/loss ratio	3.14	2.94	2.77	(P6)
Summer external temperature	15.00	16.70	16.70	
Thermal mass temperature increment (TMP = 177.6)	0.76	0.76	0.76	
Threshold temperature	18.90	20.39	20.23	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

Assessment of likelihood of high internal temperature: Not significant

SUMMARY FOR INPUT DATA
Calculation Type: New Build (As Designed)

AES Sustainability Consultants

Property Reference	4907-Z852-6657-0380	**Issued on Date**	22/01/2024
Assessment Reference	380	**Prop Type Ref**	Leadon End 1FM Op
Property	380, 1 Bed, K, B		

SAP Rating	82 B	**DER**	20.33	**TER**	21.20
Environmental	87 B	**% DER<TER**	4.08		
CO_2 Emissions (t/year)	0.95	**DFEE**	49.52	**TFEE**	55.44
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.68		

Assessor Details	Mrs. Katarzyna Gotlib, Katarzyna Gotlib, Tel: 01884 242 050, kat.gotlib@aessc.co.uk	**Assessor ID**	Z852-0001
Client	Redrow, Redrow		

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	South East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	Maisonette, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2023
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	5.18 m	4.23 m²	2.70 m
1st Storey:	23.03 m	49.75 m²	2.45 m

7.0 Living Area	20.51	m²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	177.62	kJ/m²K

9.0 External Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
90mm Supafil 34 FF	Cavity Wall	Other	0.27	52.30	56.43	48.01
90mm Supafil Hi-Strength	Cavity Wall	Other	0.28	52.30	13.98	13.98

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
E-WM-23/24/30	Solid Wall	Plasterboard on dabs mounted on cement render on both sides, AAC blocks, cavity	0.00	45.00	27.65

9.2 Internal Walls

Description	Construction	Kappa (kJ/m²K)	Area (m²)
1F Timber	Plasterboard on timber frame	9.00	92.66

10.0 External Roofs

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
400mm Plane Ceiling	External Plane Roof	Plasterboard, insulated at ceiling level	0.11	9.00	51.67	51.67

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling GF	Other	30.00	2.31

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Jetfloor 150mm Grey on Grey	Ground Floor - Solid	Suspended concrete floor, carpeted	0.18	75.00	4.23

11.1 Party Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
E-FC-14 Floor	Precast concrete plank floor (screed laid on rubber), carpeted	70.00	46.49

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
1F Internal Floor	Other	70.00	2.31

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Solid Door	Manufacturer	Solid Door							1.40
Window	BFRC data	Window	Double Low-E Hard 0.2			0.52			1.24
Patio	BFRC data	Window	Double Low-E Hard 0.2			0.52			1.24
Half Glazed Door	Manufacturer	Half Glazed Door	Double Low-E Hard 0.2			0.72		0.70	1.50
Roof Light	Manufacturer	Roof Window	Double Low-E Hard 0.2			0.72		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] 90mm Supafil 34 FF	South East							2.06	
Front Window	Window	[1] 90mm Supafil 34 FF	South East	None	0.00					2.62	
RHS Windows	Window	[1] 90mm Supafil 34 FF	North East	None	0.00					0.93	
Rear Windows	Window	[1] 90mm Supafil 34 FF	North West	None	0.00					2.81	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Calculate Bridges	

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	7.12	0.199	No	Redrow EF Series E2 - FF
Independently assessed	E3 Sill	6.14	0.008	No	Redrow EF Series E3 - FF
Independently assessed	E4 Jamb	16.05	0.003	No	Redrow EF Series E4 - FF
Independently assessed	E5 Ground floor (normal)	5.18	0.059	No	E5 - Jetfloor Average BT02
Independently assessed	E6 Intermediate floor within a dwelling	2.32	-0.002	No	Redrow EF Series E6 - FF
Table K1 - Approved	E7 Party floor between dwellings (in blocks of flats)	20.55	0.070	No	E7 - MCI-GF-01
Independently assessed	E10 Eaves (insulation at ceiling level)	13.90	0.060	No	Redrow EF Series E10
Independently assessed	E24 Eaves (insulation at ceiling level - inverted)	1.05	0.120	No	E24 - Shared - 1/2
Table K1 - Default	E24 Eaves (insulation at ceiling level - inverted)	1.63	0.240	No	E24 - Default
Independently assessed	E12 Gable (insulation at ceiling level)	12.76	0.063	No	E12 - CD0031
Independently assessed	E16 Corner (normal)	9.66	0.051	No	Redrow EF Series E16
Independently assessed	E18 Party wall between dwellings	4.00	0.060	No	Redrow EF Series E18
Table K1 - Default	E25 Staggered party wall between dwellings	2.45	0.120	No	E25 - Default
Table K1 - Default	P1 Party wall - Ground floor	4.18	0.160	No	P1 - Default
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	7.04	0.035	No	Redrow EF Series P4

Y-value	0.058	W/m²K

18.0 Pressure Testing	Yes	
Designed AP_{50}	5.01	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP_{50}		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows half open
Cross ventilation possible	Yes
Night Ventilation	No
Air change rate	4.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				2
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	10	
Total number of L.E.L. fittings	10	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No	

23.0 Electricity Tariff	Standard	

24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	17929	

Fuel Type	Mains gas
Main Heating	BGW
SAP Code	104
In Winter	90.5
In Summer	87.3
Controls	CBE Programmer, room thermostat and TRVs
PCDF Controls	0
Delayed Start Stat	Yes
Sap Code	2106
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	None
25.0 Main Heating 2	None
Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
29.0 Hot Water Cylinder	None

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None